Hoofdstuk 14

Bijlage 14.1

Sum of Squares for Treatments

$$SST = \sum_{j=1}^{k} n_j(\bar{x}_j - \bar{\bar{x}})^2$$

Bijlage 14.2

Als:

$$\bar{x}_1 = \bar{x}_2 = \cdots = \bar{x}_k$$

Dan:

$$SST = 0$$

Hieruit volgt dat een kleine waarde voor SST de nulhypothese ondersteunt. In dit voorbeeld wordt het gemiddelde van de steekproef en het grote gemiddelde, als volgt berekend:

$$\bar{x}_1 = 44.40$$
$$\bar{x}_2 = 52.47$$
$$\bar{x}_3 = 51.14$$
$$\bar{x}_4 = 51.84$$
$$\bar{\bar{x}} = 50.18$$

De stekproefgroottes zijn:

$$n_1 = 84$$
$$n_2 = 131$$
$$n_3 = 93$$
$$n_4 = 58$$
$$n = n_1 + n_2 + n_3 + n_4 = 84 + 131 + 93 + 58 = 366$$

Dan volgt:

$$\begin{aligned} SST &= \sum_{j=1}^{k} n_j(\bar{x}_j - \bar{\bar{x}})^2 \\ &= 84(44.40 - 50.18)^2 + 131(52.47 - 50.18)^2 \\ &\quad + 93(51.14 - 50.18)^2 + 58(51.84 - 50.18)^2 \\ &= 3{,}738.8 \end{aligned}$$

Bijlage 14.4

Mean Square for Treatments

$$MST = \frac{SST}{k-1}$$

Bijlage 14.5

Mean Square for Error

$$MSE = \frac{SSE}{n-k}$$

Bijlage 14.6

Test Statistic

$$F = \frac{MST}{MSE}$$

Bijlage 14.7

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$(\bar{x}_1 - \bar{x}_2) \pm t_{\alpha/2}\sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

Bijlage 14.8

Sums of Squares in the Randomized Block Experiment

$$\text{SS(Total)} = \sum_{j=1}^{k}\sum_{i=1}^{b}(x_{ij} - \bar{\bar{x}})^2$$

$$\text{SST} = \sum_{j=1}^{k} b(\bar{x}[T]_j - \bar{\bar{x}})^2$$

$$\text{SSB} = \sum_{i=1}^{b} k(\bar{x}[B]_i - \bar{\bar{x}})^2$$

$$\text{SSE} = \sum_{j=1}^{k}\sum_{i=1}^{b}(x_{ij} - \bar{x}[T]_j - \bar{x}[B]_i + \bar{\bar{x}})^2$$

Bijlage 14.9

Mean Squares for the Randomized Block Experiment

$$\text{MST} = \frac{\text{SST}}{k - 1}$$

$$\text{MSB} = \frac{\text{SSB}}{b - 1}$$

$$\text{MSE} = \frac{\text{SSE}}{n - k - b + 1}$$

Bijlage 14.10

Test Statistic for the Randomized Block Experiment

$$F = \frac{\text{MST}}{\text{MSE}}$$

which is F-distributed with $\nu_1 = k - 1$ and $\nu_2 = n - k - b + 1$ degrees of freedom.

Bijlage 14.11

Sums of Squares in the Two-Factor Analysis of Variance

$$\text{SS(Total)} = \sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{r}(x_{ijk} - \bar{\bar{x}})^2$$

$$\text{SS(A)} = rb\sum_{i=1}^{a}(\bar{x}[\text{A}]_i - \bar{\bar{x}})^2$$

$$\text{SS(B)} = ra\sum_{j=1}^{b}(\bar{x}[\text{B}]_j - \bar{\bar{x}})^2$$

$$\text{SS(AB)} = r\sum_{i=1}^{a}\sum_{j=1}^{b}(\bar{x}[\text{AB}]_{ij} - \bar{x}[\text{A}]_i - \bar{x}[\text{B}]_j + \bar{\bar{x}})^2$$

$$\text{SSE} = \sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{r}(x_{ijk} - \bar{x}[\text{AB}]_{ij})^2$$

Bijlage 14.12

F-Tests Conducted in Two-Factor Analysis of Variance

Test for Differences between the Levels of Factor A

H_0: The means of the *a* levels of factor A are equal

H_1: At least two means differ

Test statistic: $F = \dfrac{MS(A)}{MSE}$

Test for Differences between the Levels of Factor B

H_0: The means of the *b* levels of factor B are equal

H_1: At least two means differ

Test statistic: $F = \dfrac{MS(B)}{MSE}$

Test for Interaction between Factors A and B

H_0: Factors A and B do not interact to affect the mean responses

H_1: Factors A and B do interact to affect the mean responses

Test statistic: $F = \dfrac{MS(AB)}{MSE}$

Bijlage 14.13
De volgende hypotheses worden opgesteld:
H 0 : De gemiddeldes van de vier levels van factor B zijn gelijk.
H 1 : ten minste twee gemiddeldes verschillen van elkaar.

Test statistic: $F = \dfrac{MS(B)}{MSE}$

Value of the test statistic: From the computer output, we find

MS(B) = 45.28 and MSE = 10.09. Thus, $F = 45.28/10.09 = 4.49$ (p-value = .0060).

Er is voldoende bewijs om bij een 5% siginifacantieniveau te concluderen dat
verschillen in het aantal banen bestaan tussen opleidingsniveaus.

Bijlage 14.14